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SEMINAR

An objective FE-formulation for finite deformation rods based on the spherical Bézier interpolation with applications to articulated structures

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Timetable:
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Abstract
A generalization of the spherical linear interpolation (or slerp) for the finite rotations to the case of more than two control variables on SO(3) is introduced to design an objective FE-formulation for the non-linear space Cosserat rod model [1]. In this way, the same interpolation degree can be used for the placement of the centroid curve and for the finite rotation of the cross-section. The interpolation uses the De Casteljau's algorithm. The case of slender Kirchhoff-Love rods is also discussed [2]. The results reduce to those introduced by Crisfield and Jelenic for two points interpolation [3].
The model is applied to the simulation of compliant mechanisms largely used in mechanical devices, for which a robust formulation either for rigid rotation and for elastic deformations is needed.

References
[1] L. Greco, A. Cammarta, D: Castello, M. Cuomo, An objective FE-formulation for Cosserat rods based on the spherical Bézier interpolation, Computer Methods in Applied Mechanics and Engineering, Volume 425, 15 May 2024, 116947.
[2] L. Greco, D. Castello, M. Cuomo. An objective and accurate G1-conforming mixed Bezier FE-formulation for Kirchhoff-Love rods, Mathematics and Mechanics of Solids, 2023.
[3] M.A. Crisfield and G. Jeleni´c, Objectivity of strain measures in the geometrically exact three-dimensional beam theory and its finite-element implementation, Proceedings of the Royal Society of London. Series A: Mathematical, Physical and Engineering Sciences, 455(1983):1125 - 1147, 1999.

Prof. Massimo Cuomo has been a Full Professor of Structural Mechanics since October 2001. He teaches Structural Mechanics courses for the Bachelor's Degree in Industrial Engineering and courses in Computational Mechanics and Constitutive Models of Traditional and Innovative Construction Materials for the Master's Degree in Structural and Geotechnical Civil Engineering. His research activity mainly focuses on Computational Mechanics of solids and structures, the mechanics of materials with damage, and multiscale analysis of metamaterials. He has been responsible for various research projects, both within the framework of PRIN projects and CNR projects, as well as cooperation projects with European universities. Professor Cuomo was the coordinator of the Italian Group of Computational Mechanics (GIMC) from 2008 to 2013 and a member of the General Assembly of ECCOMAS (European Congress on Computational Methods in Applied Sciences and Engineering) and the General Council of IACM (International Association of Computational Mechanics). He is currently the coordinator of the National PhD program in Defense Against Natural Risks and Ecological Transition of the Built Environment.

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